CLAIMS

What is claimed is:

1. A process for fabrication of a semiconductor device including an ONO structure, comprising forming the ONO structure by:

providing a semiconductor substrate having a silicon surface;

forming a first oxide layer on the silicon surface;

depositing a silicon nitride layer on the first oxide layer; and

forming a top oxide layer on the silicon nitride layer,

wherein the top oxide layer is formed by an in-situ steam generation oxidation of a surface of the silicon nitride layer.

2. The process of claim 1, wherein the semiconductor device comprises a two-bit EEPROM device or a floating gate FLASH device.

3. The process of claim 2, wherein the semiconductor device is a two-bit EEPROM device in which the first oxide layer is a tunnel oxide layer, and the tunnel oxide layer is formed by an in-situ steam generation oxidation of the silicon surface.

4. The process of claim 2, wherein the semiconductor device is a floating gate EEPROM device in which the first oxide layer is a bottom oxide layer, and the bottom oxide layer is formed by an in-situ steam generation oxidation of the silicon surface.

5. The process of claim 1, wherein the steps of forming an oxide layer, depositing a silicon nitride layer and forming a top oxide layer are carried out in an RTP and RTCVD apparatus.

6. The process of claim 1, wherein the steps of forming an oxide layer, depositing a silicon nitride layer and forming a top oxide layer are carried out in a single-wafer cluster tool.

7. The process of claim 1, wherein the silicon nitride is deposited by RTCVD.

8. The process of claim 1, wherein each step of in-situ steam generation oxidation is carried out by providing a hydrogen-containing gas and an oxygen-containing gas to an RTP system or to a single-wafer cluster tool.

9. The process of claim 1, wherein the in-situ steam generation oxidation is carried out at a temperature in the range from about 850°C to about 1150°C.

10. The process of claim 1, wherein the step of depositing a silicon nitride layer comprises RTCVD using about 0.5 to 2 slpm ammonia and about 20 to about 50 sccm of a second gas selected from the group consisting of silane and dichlorosilane.

11. The process of claim 10, wherein the RTCVD process comprises a three step sequence including a temperature ramp up step, a deposition step of about 2 minutes, and a cool down step.

12. The process of claim 1, wherein the silicon nitride layer is deposited to a thickness of about 50 to about 300 angstroms.

13. The process of claim 1, wherein the top oxide layer is formed to a thickness of about 50 to about 150 angstroms.

14. A process for fabrication of a semiconductor device, the device including a two-bit EEPROM device including an ONO structure, comprising forming the ONO structure by:

providing a semiconductor substrate having a silicon surface;

forming a tunnel oxide layer overlying the silicon surface;

depositing a silicon nitride layer overlying the tunnel oxide layer; and

forming a top oxide layer overlying the silicon nitride layer by in-situ steam generation oxidation of a portion of the silicon nitride layer.

15. The process of claim 14, wherein the steps of forming a tunnel oxide layer, depositing a silicon nitride layer and forming a top oxide layer are carried out in an RTP apparatus which is a component of a single-wafer cluster tool.

16. The process of claim 14, wherein the silicon nitride is deposited by RTCVD.

17. The process of claim 12, wherein each step of in-situ steam generation oxidation is carried out at a temperature in the range from about 850°C to about 1150°C and by providing hydrogen gas and oxygen gas to the RTP apparatus.

18. A process for fabrication of a semiconductor device, the device including a floating gate FLASH structure comprising an ONO structure, comprising forming the ONO structure by:

providing a semiconductor substrate having a floating gate electrode;

forming a bottom oxide layer overlying the floating gate electrode;

depositing a silicon nitride layer overlying the tunnel oxide layer; and

forming a top oxide layer overlying the silicon nitride layer by in-situ steam generation oxidation of a portion of the silicon nitride layer.

19. The process of claim 18, wherein the steps of forming a bottom oxide layer, depositing a silicon nitride layer and forming a top oxide layer are carried out in an RTP apparatus which is a component of a single-wafer cluster tool.

20 The process of claim 18, wherein the silicon nitride is deposited by RTCVD.

21. The process of claim 18, wherein each step of in-situ steam generation oxidation is carried out at a temperature in the range from about 850°C to about 1150°C and by providing hydrogen gas and oxygen gas to the RTP apparatus.